Triangle Tech Tips
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Concrete Surface Dusting: Causes & Prevention

"Dusting" is when the surface of hardened concrete breaks down into a loose powder. This is also sometimes referred to as "chalking." These surfaces are easily turned into powder under any kind of traffic and can be scratched easily.

What causes concrete surface dusting?

A concrete surface dusts under traffic due to weakness of the wear surface. This weakness can be caused by numerous factors, including:

1. Performing any finishing operation while there is bleed water on the surface or before the concrete has finished bleeding. Working this bleed water back into the top 1/4 inch of the slab creates a surface layer with a very high water-cement ratio, resulting in low strength.
2. Placing concrete over a non-absorptive subgrade or polyethylene vapor retarder reduces normal absorption by the subgrade, increases bleeding, and thus raises the risk of surface dusting.
3. Conducting floating and/or troweling operations after moisture condenses from warm humid air onto cold concrete. In cold weather, particularly with concrete in basement floors, the concrete sets slowly. If the humidity is relatively high, water will condense on the freshly placed concrete. If this water is troweled into the surface, it will lead to dusting.
4. Insufficient ventilation in enclosed spaces. Carbon dioxide emitted from open salamanders, gasoline engines or generators, power buggies, or mixer engines may cause a chemical reaction called carbonation, significantly reducing the strength and hardness of the concrete surface.
5. Lack of proper curing frequently leads to a soft surface layer that readily dusts under foot traffic.
6. Failure to adequately shield freshly poured concrete from rain, snow, or drying winds can cause the surface to freeze, weakening it and leading to dusting.

Methods to prevent concrete surface dusting:

Use a concrete mix with minimal water content & suitable slump.

Concrete with minimal water content, yet with a suitable slump for placement and finishing, yields a robust, long-lasting, and wear-resistant surface. It's advisable to utilize concrete with a moderate slump, generally not exceeding 5 inches. If a higher slump is necessary, the concrete mixture should be formulated to achieve the required strength without excessive bleeding or separation. Water-reducing admixtures are commonly employed to enhance slump while keeping water content low. This becomes crucial, especially in cold weather conditions where delayed setting prolongs bleeding.

DO NOT, under any circumstances, add dry cement into the surface of plastic concrete to absorb bleed water.

Avoid sprinkling or troweling dry cement onto the surface of plastic concrete to absorb bleed water. Instead, eliminate bleed water by dragging a garden hose across the surface. To minimize excessive bleeding of concrete, consider using air-entrained concrete, adjusting mix proportions, or accelerating the setting time.

Never perform finishing operations while water remains on the surface or while the concrete continues to bleed.

Avoid performing any finishing operations while water is present on the surface or while the concrete is still bleeding. Immediately follow initial screeding with bull floating to prevent bleed water from being incorporated into the surface layer. Refrain from using a jitterbug, as it tends to bring excess mortar to the surface. Never add water to the surface to aid in finishing operations.

DO NOT place concrete directly on polyethylene vapor retarders or non-absorptive subgrades.

Avoid placing concrete directly on polyethylene vapor retarders or non-absorptive subgrades as it can lead to issues like dusting, scaling, and cracking. Instead, lay down 3 to 4 inches of a trimmable, compactible fill, such as crusher-run material, over vapor retarders or non-absorptive subgrade before pouring concrete. In instances of high evaporation rates, lightly moisten absorptive subgrades just before concrete placement, ensuring water does not pool or accumulate on the subgrade surface.

Ensure proper curing by applying an appropriate cover.

Ensure proper curing by applying a liquid membrane curing compound or covering the surface with water, damp burlap, or other curing materials immediately after finishing to maintain moisture in the slab. Protecting the concrete from environmental factors in its early stages is crucial.

Ensure adequate concrete temperature in cold weather.

To pour concrete successfully in cold weather, ensure the concrete temperature stays above 50°F. This often involves using an accelerating admixture to achieve the necessary temperature and promote proper setting and curing despite the cold. Cold temperatures slow down concrete hydration, causing delays in setting and strength development. Maintaining suitable temperatures throughout the process is crucial to mitigate these effects and ensure concrete quality.

Table 1: Five Basic Rules to Prevent Dusting

1.	Utilize concrete with a moderate slump, ensuring it does not exceed 5 inches.
2.	Avoid commencing finishing operations while the concrete is still bleeding.
3.	Refrain from broadcasting cement or sprinkling water on concrete before or during finishing operations.
4.	Ensure proper ventilation to exhaust gases from gas-fired heaters in enclosed spaces.
5.	Implement sufficient curing techniques to preserve moisture in the concrete during the initial 3 to 7 days.

Methods for repairing dusting or chalking of concrete:

1. Sandblast, shot blast, or use a high-pressure washer to eliminate the weak surface layer.

2. To minimize or eliminate dusting, apply a commercially available chemical floor hardener, such as sodium silicate (water glass) or metallic zinc or magnesium fluosilicate, following the manufacturer's directions on thoroughly dried concrete. If dusting persists, consider using a coating such as latex formulations, epoxy sealers, or cement paint.

3. In severe cases, achieve a serviceable floor by wet-grinding the surface to durable substrate concrete. This may be followed by properly bonded placement of a topping course. If this is not feasible, consider installing a floor covering like carpeting or vinyl tile, which is the most cost-effective solution to severe dusting. However, be aware that preparation is required since adhesives for floor covering materials won't adhere to floors with a dusting problem, and dusting can penetrate through carpeting.